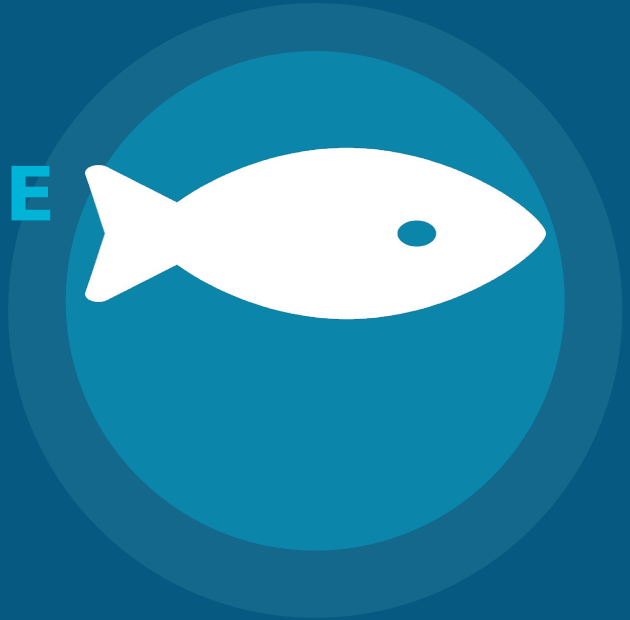
FISH & AQUATIC SAMPLE

PRESERVATION

Field Collection · Laboratory Processing · Museum Storage



Monkey Bay Capture Fisheries Centre
Seminar room | 28 May 2026

What We Will Cover Today

01 Why Preserve?

02 Sample Types

03 Preservation Chemicals

04 Field Protocols

05 Dilution Formulas

06 Long-Term Storage

07 Health & Safety

08 Best Practices

Why Preserve?

The scientific case for specimen preservation

Scientific Research

Critical for taxonomic studies, genetic analysis

Reference Collections

Museum collections serve as permanent biodiversity records

Education & Training

Preserved specimens

Biodiversity Documentation

Tracking species

Prevent Deterioration

Biological material degrades quickly

Aquatic Sample Types in Fisheries & Environmental Science

Fish

- Whole specimens (small & large)
- Fish tissue samples (fin clips, muscle)
- Otoliths (ear stones) for age determination
- Scales & stomach contents

Benthic Invertebrates

- Molluscs e.g snails
- Crustaceans such as crabs
- Worms (Oligochaeta, Polychaeta)
- Insects larvae (chironomids, EPT)

Macroinvertebrates

- Mayflies (Ephemeroptera)
- Stoneflies (Plecoptera)
- Caddisflies (Trichoptera)
- Dragonflies, beetles, water bugs

Plankton

- Zooplankton (Cladocera, Copepoda)
- Phytoplankton (preserved for counting)
- Ichthyoplankton (fish eggs & larvae)
- Periphyton (scraping samples)

Aquatic Plants

- Macrophytes (whole or pressed)
- Algae samples (in ethanol or formalin)
- Seagrass, reed samples
- Root & substrate material

Sediment & Water

- Core samples for benthic organisms
- Water chemistry samples (cooled)
- Sediment for diatom analysis
- Stable isotope material (frozen)

Preservation Methods

Three broad categories — choose based on purpose and available resources

PHYSICAL

- Freezing (-20°C or -80°C): best for DNA/genetics
- Refrigeration (4°C): short-term, <48 h
- Drying: insects, plants
- Press-drying: herbarium macrophytes

CHEMICAL

- Formalin (10%): fixation, tissue hardening
- Ethanol (70%): long-term storage
- Buffered formalin: reduces acid damage
- Isopropanol: cheaper, less ideal

BIOLOGICAL

- Live cultures: phytoplankton, bacteria
- Cryopreservation with cryoprotectants
- Voucher storage in cell banks
- Combined with cryo-fixatives (OsO_4)

 For fisheries & environmental science, Chemical preservation (formalin + ethanol) is the primary method.

Formalin — Properties, Uses & Safety

What Is Formalin?

- Commercial formalin is 37–40% formaldehyde (HCHO) gas dissolved in water
- When diluted to 10%, it contains ~3.7–4% formaldehyde — sufficient for fixation
- Acts by cross-linking proteins — 'fixing' tissues in place and halting bacterial decay
- Excellent at preserving tissue
- Causes gradual bleaching/discolouration of pigments over time
- Acidifies over time — use buffered formalin to protect bones & scales
- Field use: initial fixation for 24–48 hours before transferring to ethanol

⚠ Health & Safety

- ❑ CARCINOGEN
- ❑ Irritant
- ❑ REQUIRED PPE
- ❑ Never pipette formalin by mouth
- ❑ If skin contact: rinse with water for 15 minutes immediately
- ❑ Store in a cool, dark, well-ventilated location away from heat sources
- ❑ Disposal: do NOT pour down drains — use authorised chemical waste disposal

Ethanol — Properties, Uses & Advantages

Ethanol (Ethyl Alcohol)

Concentration Guide

Concentration	Use Case	Risk
30–50%	Short-term transport	Microbial growth possible
70–75%	Long-term storage	Ideal balance
80–90%	Tissue dehydration	Brittleness risk
95–100%	DNA preservation	Shrinks tissues fast

⚠ Ethanol is flammable — keep away from open flames. Store in tightly sealed, labelled containers.

Dilution Formula: Formalin

How to prepare 10% formalin (≈ 4% formaldehyde) from commercial stock (37–40%)

General Dilution Formula ($C_1 \times V_1 = C_2 \times V_2$)

C_1 = stock concentration (37%) | V_1 = volume of stock to add

C_2 = desired concentration (10%) | V_2 = total final volume

$V_1 = (C_2 \times V_2) / C_1 \rightarrow V_1 = (10 \times V_2) / 37$

Worked Examples

Tip: Add formalin to water — never add water to concentrated formalin (exothermic reaction)

Dilution Formula: Ethanol

How to prepare 70% and 95% ethanol from absolute (100%) ethanol

General Dilution Formula ($C_1 \times V_1 = C_2 \times V_2$)

C_1 = stock concentration (e.g. 100%) | V_1 = volume of stock to add

C_2 = desired concentration (70% or 95%) | V_2 = total final volume

$V_1 = (C_2 \times V_2) / C_1$ → For 70%: $V_1 = 0.70 \times V_2$

Worked Examples

Note: Use distilled or deionised water for dilutions — tap water may contain minerals that affect preservation quality.

The Standard Combination Method: Field → Lab → Museum

01

Collect samples

Record GPS, date, habitat, collector name before handling specimen.

02

Photograph First

BEFORE fixation — colour fades irreversibly in formalin

03

Measure & Record

Total length, standard length, body weight, sex (if determinable).

04

Fix in 10% Formalin

Submerge specimen fully.

05

Rinse & Transfer

Remove from formalin. Rinse briefly in water. Transfer to 70% ethanol for long-term storage. Label jar immediately.

06

Label & Catalogue

Waterproof internal label + external label. Include: species, collection site, date, collector

Benthic Invertebrate Preservation

Benthic invertebrates = organisms living on/in the substrate: snails, clams, worms, crustaceans, insect larvae

- Fix in 10% formalin 24–48 h
- Transfer to 70% ethanol for storage
- Retain shell with animal inside jar
- For shell-only: dry & label separately
- Use vials, not jars — tiny specimens

Plankton & Water Column Sample Preservation

Zooplankton (Cladocera, Copepoda, Rotifera)

- Collect with 50–100 µm plankton net — vertical or horizontal tow
- Fix immediately with Lugol's iodine solution (1–2% final conc.) — best for counting
- OR: 4% formalin (sugar-buffered) for morphological ID
- Store in amber vials in the dark — Lugol's degrades in light
- For molecular work: collect on GF/C filter, immediately freeze at -20°C

Sediment, Water & Special Field Samples

Beyond organisms — the environmental context matters

Sediment Core Samples

- Ekman grab or core tube for fine substrate
- Section into 2–5 cm layers in labelled bags
- Freeze immediately for molecular analysis
- 4% formalin for benthic fauna extraction
- Label: site, GPS, depth, core length,

Water Chemistry

- Collect in acid-washed, pre-labelled bottles
- Chill to 4°C — analyse within 24 h or freeze
- Nutrients (N, P): add H_2SO_4 acid preservative
- Heavy metals: add HNO_3, keep at 4°C
- DO, pH, conductivity: measure in-situ only

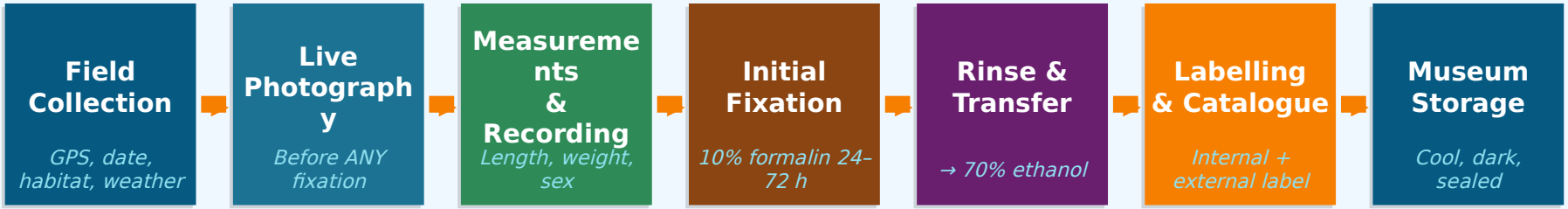
Diatoms & Periphyton

- Scrape from rocks/substrate with brush into vial
- Fix in 4% formalin or 70% ethanol
- For acid-cleaned slides: add 30% H_2O_2 + HCl
- For Acid Digest method: heat digest in Hotplate
- Label: substrate type, site, depth, date

eDNA (Environmental DNA)

- Filter 1–2 L water through 0.45 µm Sterivex filter
- Immediately store filter in lysis buffer at -20°C
- Use sterile gloves, avoid contamination
- Take field blank (filtered DI water) at each site
- Keep frozen during transport — dry ice

Field-to-Laboratory Workflow at a Glance



Field Safety

Always work in pairs near water. Wear PPE when handling chemicals in the field. Record immediately — memory fades.

Photography Rule

Photographs are IRREVERSIBLE reference. Once in formalin, colour is gone. Budget 5 min per specimen for photos.

Chain of Custody

Each specimen needs a unique field number linking field notes, photos and physical specimen throughout the workflow.

Quality Control

Inspect jars after 48 h: ethanol should remain clear. Cloudiness indicates insufficient concentration — replace immediately.

Health & Safety in Preservation Work

⚠ **PPE REQUIREMENTS — Mandatory when handling formalin, ethanol or any fixatives**

PPE Item	Required For
Nitrile gloves (double)	All chemical work
Safety goggles / face shield	Formalin, acids, bases
Lab coat / apr	All preservation work
Respirator (half-face)	Concentrated formalin
Closed-toe sh	All fieldwork & lab work
Fume hood / ventilation	Formalin dilution, use

First Aid: Formalin Exposure

Skin: flush 15 min water. Eyes: eyewash 15 min, see doctor. Inhaled: fresh air, rest, medical attention if symptoms persist.

Chemical Disposal

Never pour formalin or large volumes of ethanol down drains. Use labelled chemical waste containers.

THANK YOU

Questions & Discussion